A.D. 1866, *25th September.* N° 2466.

Steam Engines, &c.

LETTERS PATENT to Alfred Vincent Newton, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Mechanical Draughtsman, for the Invention of "Improvements in Steam Engines, Partly applicable to Pumps and other Apparatus in which Pistons or Plungers are used."—A communication from abroad by John Benjamin Root, of the City of New York, in the United States of America.

Sealed the 26th February 1867, and dated the 25th September 1866.

PROVISIONAL SPECIFICATION left by the said Alfred Vincent Newton at the Office of the Commissioners of Patents, with his Petition, on the 25th September 1866.

I, Alfred Vincent Newton, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Mechanical Draughtsman, do hereby declare the nature of the said Invention for "Improvements in Steam Engines, Partly applicable to Pumps and other Apparatus in which Pistons or Plungers are used," to be as follows:—

These improvements have reference in part to engines generally, also pumps and other valve and piston or plunger devices.

The first part of the Invention relates to that class of steam engines known as trunk engines, and more especially to that description of such engines in which the trunk that has the piston attached to it is extended through both

ends of the engine cylinder, and the object of the improvement in this connection is to reduce that pressure of the piston and trunk which usually takes place against the sides of the cylinder and trunk stuffing boxes, especially in short-stroke engines, by reason of the diagonal positions of the connecting rod at certain points in the stroke, and more particularly felt when the piston and crank are at or near half strokes, causing in course of time an irregularity of figure to the interior of the cylinder, and exterior of the trunk or interior of its stuffing box, to the detriment of the working qualities of the engine by inducing friction and leakage, also making necessary frequent renewal of the requisite packings.

The nature of this part of the Invention consists in extending the trunk through a stuffing box or its equivalent in the end or head of the cylinder furthest from the crank to more than an ordinary distance, and providing such extended portion of the trunk outside of or beyond the end of the cylinder with a fixed guide or guides parallel to the cylinder in combination with establishing the attachment of the connecting rod with the trunk and piston at such a point that it works within or between the guides throughout the entire stroke or thereabouts, thereby not only obtaining a long connecting rod to the reduction of its angle with the line of the cylinder at and near half stroke, and consequent reduction of lateral pressure, but bringing the maximum of such remaining pressure upon the guide or guides instead of upon the sides of the cylinder, such construction also affording greater convenience for oiling and tightening up the connecting rod attachment. The trunk instead of itself fitting the guides may be fitted with packing pieces of such construction as will admit of being set out by screws or other suitable means to compensate for wear, and so secure for the trunk a proper bearing against the guides to resist the lateral pressure or thrust produced by the diagonal positions of the connecting rod when the piston and crank are at or near half stroke.

The second part of the Invention relates to a similar class of engine, and it consists in constructing the guide or guides outside of or beyond the end or ends of the engine cylinder of a close or cylindrical form, and arranging the packing or packings which prevent leakage at the trunk on or in the trunk itself, and so as to move with the latter within the guide or guides, whereby the packing rings are made to form the slides within the guides, and whereby for a limited length of trunk longer cylindrical guides may be used and the engine made shorter for a given length of stroke and guide, also the construction of the packing simplified by dispensing with stuffing boxes, glands, and bolts in the ends of the guides.

The third part of the Invention relates to a peculiar mode of hanging and driving or operating the valve which admits and exhausts steam from an engine, which improvement is applicable not only to trunk but other engines, and to most or all descriptions of valves whether conical or otherwise, the faces of which travel in the arc of a circle, and it consists in working the valve by a rock shaft that has projecting from it a radial pin cylindrical at its extremity, which fitting a cavity in the valve serves to drive the latter and to allow of its self-adjustment to preserve a tight contact with its seat irrespective of the equal or unequal wear of the rock shaft in its bearings.

The last feature of the Invention relates to the packing or packings used for the engine piston and its trunk, or either, if the engine be of trunk form or character, or which may be used therefor if preferred to other packing, and which is also applicable to other engines and pistons or plungers generally, whether of engines, pumps, or other machines. This part of the Invention refers to that description of metallic packing rings which are kept tight by the pressure of the steam or other fluid by which the piston is driven, or which it is employed to move, and it consists in a novel construction of such rings whereby a tight fit both to the cylinder and and to the body of the piston is insured, and a single ring made to keep the piston tight at its cross joint or division as well as circumferentially. The ring in its transverse section is of the form of a parallelogram with its outer angles bevilled off; it is of somewhat less thickness than the groove in which it lies, and so fitted therein as to allow steam passing from the cylinder round the trunk or piston to enter past the one side or face of the ring to the back or interior thereof to force out the same, the steam thus acting alternately on opposite sides of the ring to press it outwards and against either face or side of the groove, accordingly as it is admitted to opposite sides of the engine piston alike to prevent leakage either round its outer periphery or past it through the groove in which it loosely fits. On opposite sides of the division of the ring by which its circumferential expansion is provided for, the ring is mortised through in a plane perpendicular to its axis for the reception of a flat portion of a thin joint piece which is of T shape in its transverse section, and which is fitted steam or water tight into the mortise. The portion of the joint piece is curved longitudinally and fitted steam or water tight to the interior of the ring. The pressure of the steam or other fluid admitted to the interior of the packing ring acts upon the back of the curved portion of the T-shaped joint, and so presses it out tightly against the interior of the ring and prevents leakage through the joint.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Alfred Vincent Newton in the Great Seal Patent Office on the 25th March 1867.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, ALFRED VINCENT NEWTON, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Mechanical Draughtsman, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-fifth day of September, in the year of our Lord One thousand eight hundred and sixty-six, in the thirtieth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Alfred Vincent Newton, Her special licence that I, the said Alfred Vincent Newton, my executors, administrators, and assigns, or such others as I, the said Alfred Vincent Newton, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN STEAM ENGINES, PARTLY APPLICABLE TO PUMPS AND OTHER APPARATUS IN WHICH PISTONS OR PLUNGERS ARE USED," being a communication to me from abroad, upon the condition (amongst others) that I, the said Alfred Vincent Newton, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Alfred Vincent Newton, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the Drawing hereunto annexed, and to the letters and figures marked thereon (that is to say) :—

These improvements have reference in part to engines generally, also pumps and other valve and piston or plunger devices.

The first part of the Invention relates to that class of steam engines known as trunk engines, and more especially to that description of such engines in which the trunk that has the piston attached to it is extended through both ends of the engine cylinder. The object of my improvement in this connection is to reduce that pressure of the piston and trunk which usually takes place

against the sides of the cylinder and trunk stuffing boxes, especially in short stroke engines by reason of the diagonal positions of the connecting rod at certain points in the stroke, and more particularly felt when the piston and crank are at or near half stroke, causing in course of time an irregularity of figure to the interior of the cylinder and exterior of the trunk or interior of its stuffing box, to the detriment of the working qualities of the engine by inducing friction and leakage, also making necessary frequent renewal of the requisite packings. The nature of this part of the Invention consists in extending the trunk through a stuffing box or its equivalent in the end or head of the cylinder furthest from the crank to more than an ordinary distance, and providing such extended portion of the trunk outside of or beyond the end of the cylinder with a fixed guide or guides parallel to the cylinder in combination with establishing the attachment of the connecting rod with the trunk and piston at such a point that it works within or between the guides throughout the entire stroke or thereabouts, thereby not only obtaining a long connecting rod to the reduction of its angle with the line of the cylinder at and near half stroke, and consequent reduction of lateral pressure, but bringing the maximum of such remaining pressure upon the guide or guides instead of upon the sides of the cylinder, such construction also affording greater convenience for oiling and tightening up the connecting rod attachment.

The second part of the Invention relates to a similar class of engine, and it consists in constructing the guide or guides outside of or beyond the end or ends of the engine cylinder of a close or cylindrical form, and arranging the packing or packings which prevent leakage at the trunk on or in the trunk itself, and so as to move with the latter within the guide or guides, whereby the packing rings are made to form the slides within the guides, and whereby for a limited length of trunk longer cylindrical guides may be used and the engine made shorter for a given length of stroke and guide, also the construction of the packing simplified by dispensing with stuffing boxes, glands, and bolts in the ends of the guides.

The third part of the Invention relates to a peculiar mode of hanging and driving or operating the valve which admits and exhausts steam from an engine. This improvement is applicable not only to trunk but other engines and to most or all descriptions of valves, whether conical or otherwise, the faces of which travel in the arc of a circle, and it consists in working the valve by a rock shaft that has projecting from it a radial pin cylindrical at its extremity, which fitting a cavity in the valve serves to drive the latter and to

allow of its self-adjustment to preserve a tight contact with its seat irrespective of the equal or unequal wear of the rock shaft in its bearings.

The last feature of the Invention relates to the packing or packings used for the engine piston and its trunk or either, if the engine be of trunk form or character, or which may be used therefor if preferred to other packing, and which is also applicable to other engines and pistons or plungers generally, whether of engines, pumps, or other machines. This part of the Invention refers to that description of metallic packing rings which are kept tight by the pressure of the steam or other fluid by which the piston is driven, or which it is employed to move, and it consists in a novel construction of such rings whereby a tight fit both to the cylinder and to the body of the piston is insured, and a single ring made to keep the piston tight at its cross joint or division as well as circumferentially.

The nature of the Invention, having been specified its description with reference to the accompanying Drawing forming part of this Specification will be proceeded with.

In the Drawing, Fig. 1 represents a central vertical section of a trunk engine, constructed according to this Invention; Fig. 2 is a horizontal section in the plane or planes indicated by the irregular line *x*, *x*, in Fig. 1; and Fig. 3 is an elevation of the upper end of the trunk with slide attached; Fig. 4 represents a central vertical section of a trunk engine in further illustration of the Invention; and Figures 5 and 6 are views of the improved metallic packing ring detached. Like letters indicate like parts throughout the Figures.

Referring to Figs. 1 and 2, A is the bed plate of the engine, having erected upon it suitable standards or a framing B for the support of the upright cylinder C, and having arranged upon it below the cylinder the bearings D of the crank shaft E. Here it may be observed that this portion of the description is based upon the supposition that the engine is vertically arranged, but the Invention throughout is equally applicable to horizontal or other positions of the engine. F is the piston firmly secured to the trunk G, which works through stuffing boxes or their equivalents H and I in the heads of the cylinder. The upper part of the trunk, that is to say, the part above the piston, is extended upward to a so much greater length than is usual than when the piston F and crank E^1 are at the lower end of the stroke a considerable portion of the trunk remains above the upper cylinder head. The cross head or pin J, by which the attachment of the connecting rod K is established with the trunk and piston, is arranged as near as practicable or convenient to the

upper end of the trunk. L, L, are the fixed parallel guides situated above the upper cylinder head to guide the upper part of the trunk; these guides may be bolted to the cylinder, the upper cylinder head, or to a suitable fixed bearing, and may be of circular, partly circular, or other form in their horizontal or transverse section, the upper part of the trunk, which always projects above the upper cylinder head, being of corresponding form to fit snugly within the said guides. The upper portion of the trunk may be fitted with suitable gibs or packing pieces *a*, *a*, of such construction as will suggest itself to the skilled engineer, to be set out by screws or other suitable means to compensate for wear, and so secure for the trunk a proper bearing against the guides to resist the lateral pressure or thrust produced by the diagonal positions of the connecting rod when the piston and crank are at or near half stoke. Instead of divided upper guides L, L, one continuous cylinder may be used, and if desired the packing to the trunk may be arranged within it instead of in the cylinder head. It will be readily understood that by the extension of the trunk as described, and establishing the union of the connecting rod with the trunk and piston in the so extended portion of the trunk, not only is greater convenience afforded for oiling and tightening up the connection, but a much greater than the usual length of connecting rod in proportion to the length of crank is obtained, and thereby the angle of the rod relatively to the line of the cylinder when the piston is at and near half stroke is much reduced, and the pressure of the piston and trunk against the sides of the cylinder and stuffing boxes or their equivalents is consequently considerably diminished, while such reduced pressure and friction as would fall upon the sides of the cylinder and stuffing boxes is yet further diminished by much of the same being transferred to and met by the guides L, L, whereby the durability of the engine is increased and its working capacities improved. The necessary valves and other parts or devices requisite to complete the engine are not here shown or described, as the same form no part of the present Invention, and may be of the usual or any approved description.

In Fig. 4 of the Drawing a similar construction of engine arranged horizontally is shown to that just described so far as relates to the extension of the trunk G beyond the engine cylinder C at the end opposite to or furthest from the crank E^1 and attachment of the connecting rod K in said extended end, but a continuous fixed cylinder L is here shown as a guide to the extended portion of the trunk, and instead of stuffing boxes or their equivalents in the head or heads of the cylinder the protruding portion or portions of the trunk outside

of one or both ends of the engine cylinder may be circumferentially rebated and receive in the groove so formed a packing ring M to work as a slide and establish a steam-tight fit in the cylindrical guide L, the same arrangement of packing ring in and carried by the trunk and stationary cylindrical guide being repeated if desired outside the end of the engine cylinder nearest the crank. Most of the remaining parts or devices represented in this Figure are or may be of ordinary character, including the bed A, standard or standards B, crank bearings D, and crank shaft E, crank E^1, engine piston F, and trunk and connecting rod, cross head, or pin J. By arranging the packing rings in grooves around the exterior of the trunk over, or as compared with their arrangement in stuffing boxes attached to the engine cylinder, longer fixed cylindrical guides L may be employed for a given length of trunk, thereby making the engine with a given length of stroke and guide shorter. To illustrate this let it be supposed that the rings were arranged near the outer ends of the cylindrical guides, the trunk would then have to be long enough to remain within the rings when the piston was at the end of the stroke furthest from either ring.

Another advantage of this arrangement of the packing rings consists in the simplicity of construction as compared with the insertion of such rings in guides of a similar character to stuffing boxes, such rings in the latter case requiring glands and bolts in the ends of the guides. Referring to the same Figure (Figure 4), while any suitable form and mode of operating the valve for admitting and exhausting steam to and from the engine cylinder may be used, it is preferred to employ a valve N of partially cylindrical character on its face, which is made to reciprocate in the arc of a circle on a similarly shaped seat of a valve box O, to which steam is or may be admitted by a pipe P. The valve box or its seat in or on which the valve N works may either be cylindrically straight or conical, the mode of hanging or driving and operating the valve about to be described being applicable to either, or, in fact, to most or all valves the faces of which work in the arc of a circle or arcs of circles, as the case may be, irrespective of the arrangement of the passages or particular application of such valves, the improvement having no special reference to engines of a trunk form or character. Steam being admitted to the back of the valve N it is made alternately to pass steam by the ways *b*, *b*, to opposite sides of the engine piston, and alternately to exhaust from opposite sides thereof by a cavity or cavities in it communicating with the exhaust outlet Q. To produce such action it is reciprocated or rocked by means of a rock shaft R operated through a lever or otherwise by an excentric on the engine shaft, of which *c* is

the rod. The connection between the rock shaft R and valve N is established by means of a driver *d*, consisting of a radial pin attached to the shaft R, and arranged to project loosely within the valve, and made cylindrical at its extremity, which is fitted to freely enter a similarly shaped recess in the bottom or body of the valve and establish a loose connection therewith. By this mode of hanging or driving and operating the valve play is given to the latter to turn and work on the driver to compensate for wear and adjust itself from time to time to steam-tight contact with the valve seat, regardless of the equal or unequal wear in its bearings of the rock shaft which operates the driver.

In the same view (Figure 4) and Figures 5 and 6 is represented the metallic packing ring M, which forms the subject of the fourth part of the Invention, and which is not exclusively applicable to trunk engines, but equally so to others, whether of the piston or other parts, including the stuffing boxes, also to pumps and other piston and plunger devices. It will here suffice, however, to describe it in connection either with the trunk of an engine such as represented in the Drawing or its piston. This ring M may be of a single piece, and sprung into a circumferential rebate in the body of the piston, or made to fit a groove of similar character therein formed by an annular recess in the periphery of the piston and an annular covering plate bolted on to the one side or face of the latter. Applied to the trunk of an engine it is sprung into a circumferential groove *e* made therein, or into a similarly shaped recess formed in the cylindrical guides in which the trunk works. In its transverse section the ring is of the form of a parallelogram with its outer angles *s*, *s*, bevilled off; it is of somewhat less thickness than the groove in which it lies, and so fitted therein as to allow steam passing from the cylinder round the trunk or piston to enter past the one side or face of the ring to the back or interior thereof to force out the same, the steam thus acting alternately on opposite sides of the ring to press it outwards and against either face or side of the groove, accordingly as it is admitted to opposite sides of the engine piston, alike to prevent leakage either round its outer periphery or past it through the groove in which it loosely fits. This action of the steam or other fluid by which the packing ring is kept tight is rendered much more certain and effective by the bevils *s*, *s*, on the packing ring, as the triangular space formed by the bevil on the opposite side of the ring to that on which the pressure comes is brought into communication with the atmosphere or with that end of the cylinder at which there is a reduced pressure, and hence that side of the ring is in proportion to the area of the

bevil surface relieved of pressure both circumferentially and in the direction of the length of the cylinder, and by varying the angle of the bevils the pressure may be made to act upon the rings more or less in an outward or forward direction. On opposite sides of the division *m* of the ring by which its circumferential expansion is provided for the ring is mortised through in a plane perpendicular to its axis for the reception of a flat portion *r* of a thin joint piece *r*, *u*, which is of T shape in its transverse section, and which is fitted steam or water tight into the mortise. The portion *u* of the joint piece is curved longitudinally, and fitted steam or water tight to the interior of the ring. The pressure of the steam or other fluid admitted to the interior of the packing ring acts upon the back of the curved portion *u* of the T-shaped joint *r*, *u*, and so presses it out tightly against the interior of the ring and prevents leakage through the joint *m*. The two parts *r* and *u* of the joint may be made of one piece or of two separate pieces, and in the latter case the part *u* will be attached to the ring on one side of the joint *m*, and lap over it on the opposite side of the said joint. The like effect on the packing takes place when the piston or plunger carrying it, as in the case of a pump, instead of being propelled by a fluid operates to move the latter.

Having now set forth the nature of the Invention communicated to me of "Improvements in Steam Engines, Partly applicable to Pumps and other Apparatus in which Pistons or Plungers are used, and explained the manner of carrying the same into effect, I wish it to be understood that under the above in part recited Letters Patent I claim,—

First, the guide or guides L, L, (Fig. 1) parallel with the engine cylinder, and arranged outside of or beyond that end of the cylinder of a trunk engine farthest from the crank, and receiving or embracing an extended portion of the trunk and the attached end of the connecting rod, substantially as herein specified.

Second, the arrangement of a packing ring or rings within and around the trunk in combination with the cylindrical guide or guides L (Figure 4) attached to the cylinder or otherwise equivalently supported and arranged essentially as and for the purpose or purposes herein set forth.

Third, the combination with a valve, the face of which moves in the arc of a circle, of a driver *d* operated by a rocking shaft R, and loosely fitting as its cylindrical extremity a cavity in the valve, substantially as shown and described.

Fourth, the packing ring M bevilled at its outer edges, as shown at *s*, *s*, in Figures 5 and 6, also formed with a T or other joint at its division, and

arranged to fit a groove in the body it serves to pack for operation by pressure of the propelling agent or fluid it serves to move, substantially as herein set forth.

In witness whereof, I, the said Alfred Vincent Newton, have hereunto set my hand and seal, the Twenty-fifth day of March, in the year of our Lord One thousand eight hundred and sixty-seven.

A. V. NEWTON. (L.S.)

Witness,

J. W. MOFFATT,

66, Chancery Lane.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1867.

A.D. 1866. Sep. 25. N° 2466.
NEWTON'S Specification.

FIG. 1.

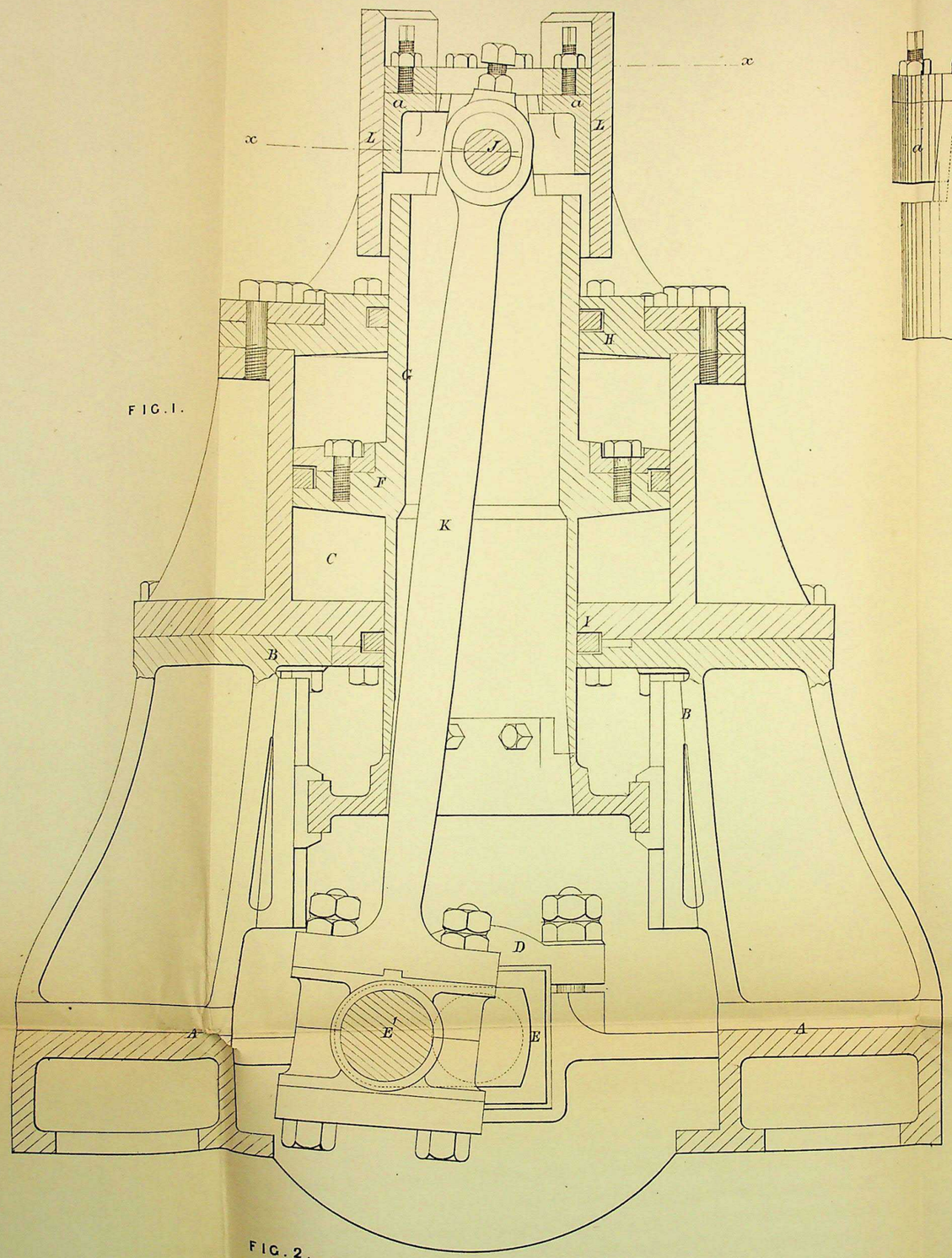


FIG. 2.

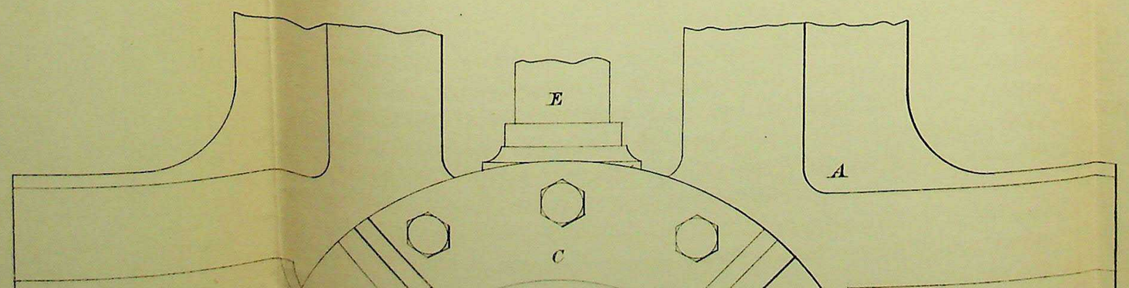


FIG. 3.

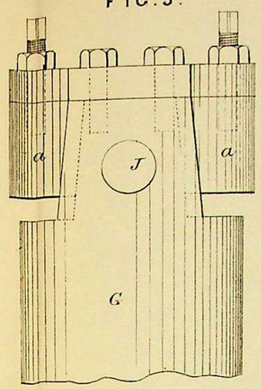


FIG. 4.

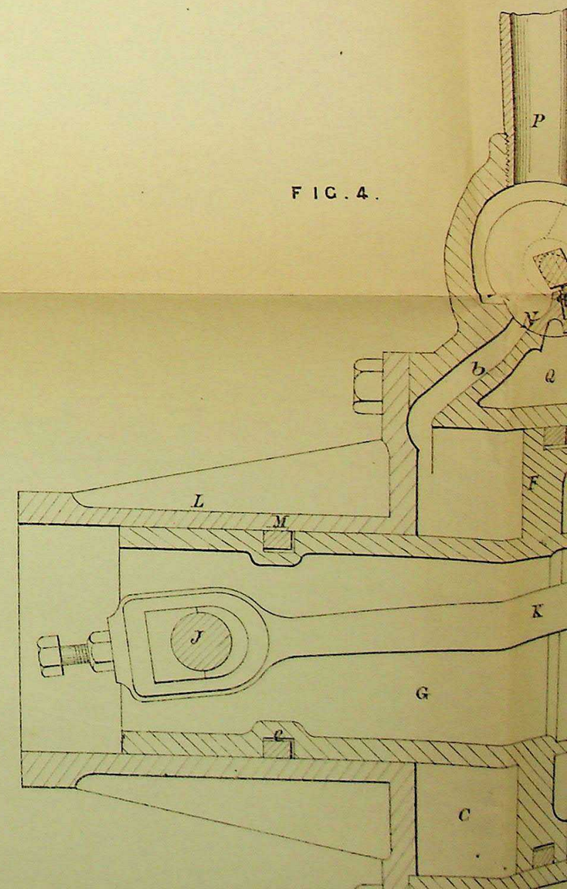


FIG. 3.

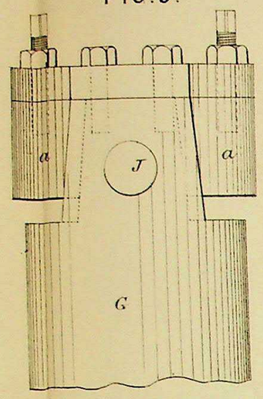


FIG. 5.

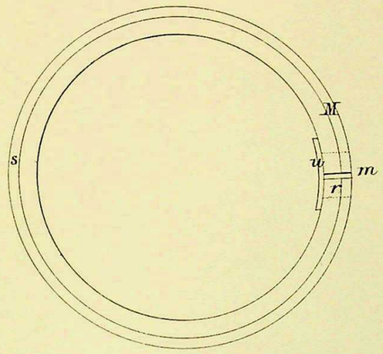


FIG. 6.

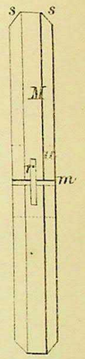
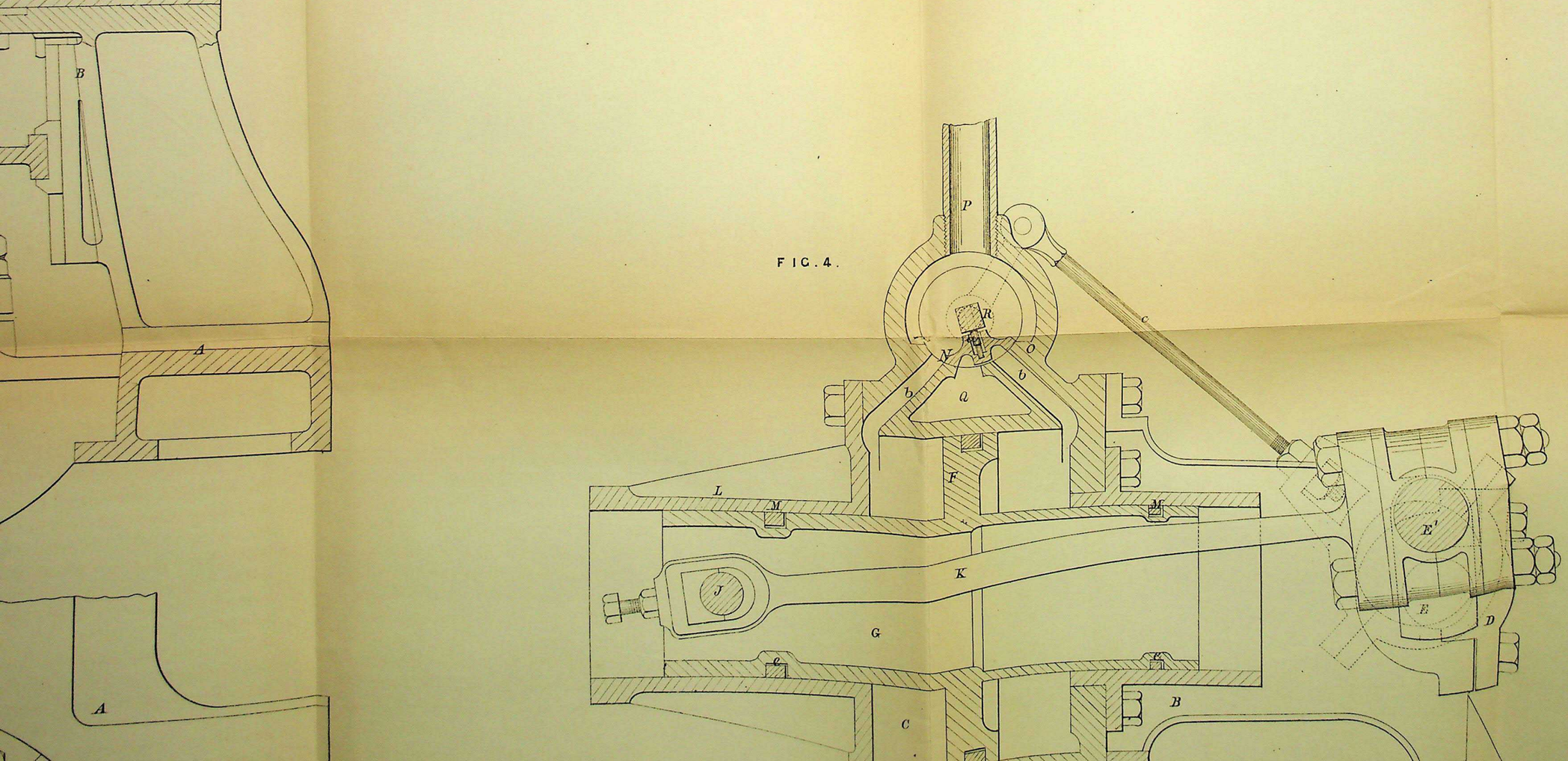
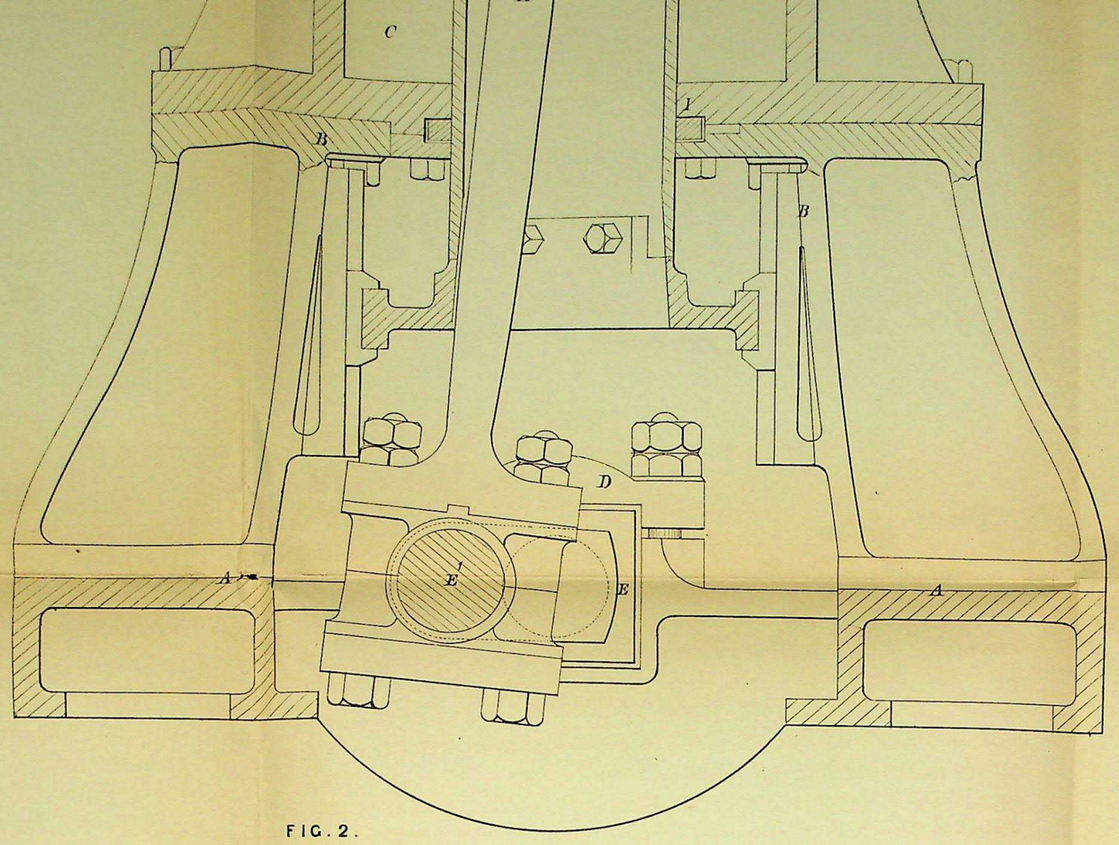


FIG. 4.





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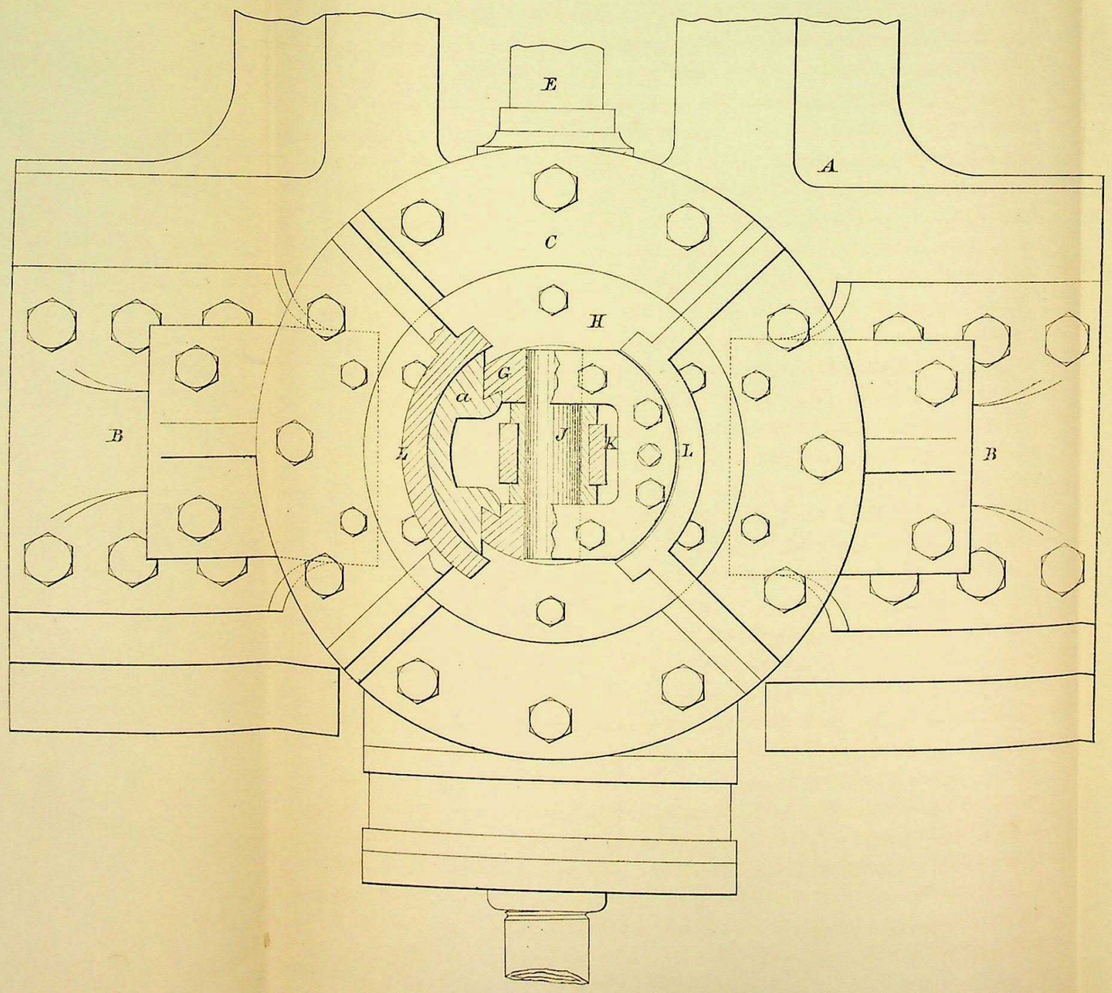
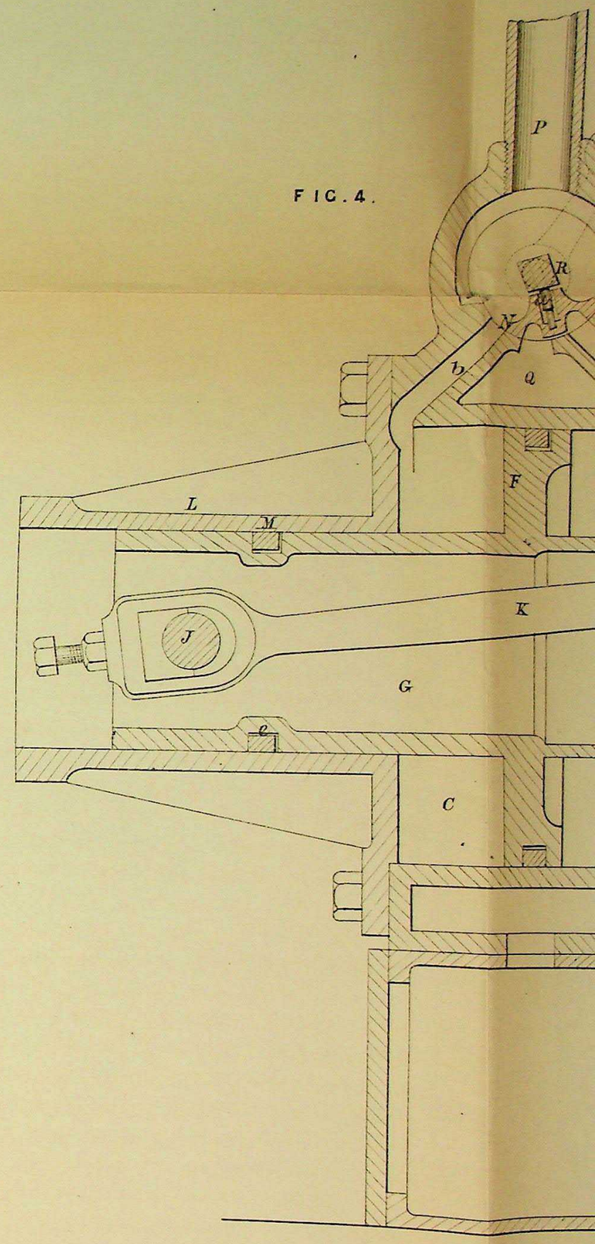
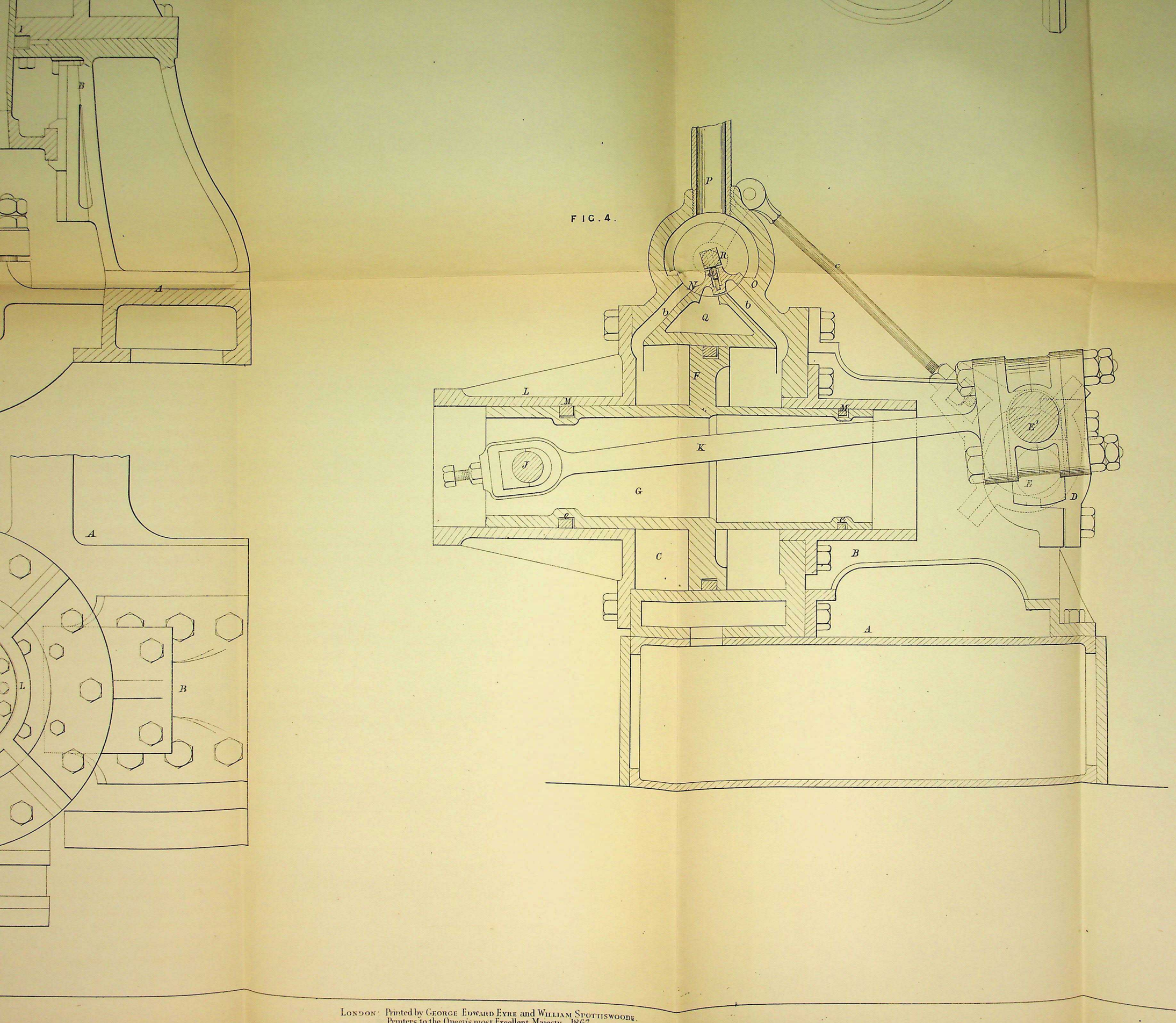


FIG. 4.



The filed drawing is partly colored.

FIG. 4.



Drawn on Stone by Malby & Sons

London: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1867